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PROGNOSIS OF BLACK CHILDREN WITH ACUTE LYMPHOCYTIC LEUKEMIA

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To assess the racial differences in survival of children with acute lymphocytic leukemia, we analyzed data for 1,675 white and 126 black children, diagnosed from 1955 to 1969. Blacks had a significantly shorter median survival and lower one-year and three-year survival rates than whites. There was substantial variation in racial differences by age. In addition, much of the variation between races seemed to be due to socioeconomic factors rather than strictly racial ones. Identification of the specific factors responsible for the poorer survival of children from lower social classes is sorely needed.

KEY WORDS: acute lymphocytic leukemia, Negroes, epidemiology, survival, socioeconomic factors

INTRODUCTION

In the United States, leukemia and other cancers are now the leading cause of death from disease in children more than one year old. With early diagnosis and improved therapy, longer median survivals are being achieved. We report here some of the epidemiologic variables affecting survival in black children with acute lymphocytic leukemia from a broader geographic base than was previously available (1–3).

MATERIALS AND METHODS

The End Results Group coordinates a program involving more than 100 hospitals in the United States to evaluate the outcome of cancer therapy (4,5). Our study concerned

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patients under age 16 years, reported to this program from 1955 to 1969, whose leukemia was histopathologically confirmed as acute lymphocytic, acute lymphoblastic, acute stem cell, or acute undifferentiated. All of these were considered equivalent to acute lymphocytic leukemia (ALL).

Median survival and one-year and three-year survival rates were calculated according to age at diagnosis, race, and sex. When comparing survival rates for all ages, to account for the discrepancy in age at diagnosis between blacks and whites, we determined a survival rate for blacks that was standardized to the age distribution of the whites (6).

The tests for significant differences between the one-year survival rates of the various categories were the standard chi square and the chi square after stratification on a control variable (age) as described by Mantel and Haenszel (7). The test for significant differences between two median survivals was that described by Siegel (8).

RESULTS

In the total series of 2,354 children with acute leukemia, 76.8% of the whites and 72.8% of the blacks were diagnosed as having acute lymphocytic leukemia by our criteria. The difference between these percentages was not significant ($p > 0.50$). For the children with acute lymphocytic leukemia, the median age at diagnosis was 3.6 years for the whites and 3.9 years for the blacks, and the respective ratios of boys to girls were 1.3 and 1.1. There was no significant difference between the age at diagnosis of the boys and that of the girls in either racial group.

Three-year follow-up could not be obtained for 11 whites (no blacks). Three-year survival rates were 9.8% for blacks and 13.4% for whites ($p > 0.50$). In view of the small number of three-year survivors, median months of survival and one-year survival rates were used to evaluate the prognosis of blacks relative to whites (Table I). Median survival was 9.9 months for blacks and 11.5 months for whites ($p < 0.025$). There was, however, considerable variation in the difference between black and white survival by age at diagnosis. The greatest difference in survival was for children under two years of age, for

TABLE I. Median Survival and One-Year Survival Rate by Age and Race

	Number of cases		Median survival (months)		One-year survival rate (%)	
Age (years)	Black	White	Black	White	Black	White
0–1	17	211	3.6	7.9*	5.9	36.4**
2–4	49	714	9.6	13.2*	34.7	53.9**
5–7	25	343	16.5	12.7	59.5	52.0
8–15	35	407	7.9	9.8*	22.9	40.9
All ages	126	1675	9.9†	11.5*	33.3†	48.1**

*White median survival significantly greater ($p < 0.025$) than corresponding median for blacks.
**White one-year survival rate significantly greater ($p < 0.05$) than corresponding rate for blacks.
†Standardized to age distribution of whites.

which median survival was 4.3 months longer for whites than for blacks ($p < 0.025$). Blacks exceeded whites in median survival for only one age group, 5–7, and did so by 3.8 months ($p > 0.50$). The analysis of survival by one-year and three-year survival rates demonstrated age-specific differences similar to those seen for median months of survival.

Because racial differences may be confounded by social class differences, an attempt was made to control for socioeconomic factors by dividing the series into those patients from private hospitals and those from county and charity hospitals (Table II). For children diagnosed at private hospitals, the whites had a significantly higher one-year survival rate than the blacks ($p < 0.05$), and for county/charity hospitals, the white rate was

TABLE II. Median Survival and One-Year Survival Rate by Age, Race, and Hospital Type

	Number of cases		Median survival (months)		One-year survival rate (%)	
Age (years)	Black	White	Black	White	Black	White
Private hospitals						
0–1	6	190	3.0	8.0	0.0	36.2
2–4	18	653	9.0	13.4	22.2	54.9
5–7	11	320	22.0	13.0	72.2	52.9
8–15	13	378	9.0	9.9	30.8	40.9
All ages	48	1541	10.9*	11.8*	31.8*	48.8*
County and charity hospitals						
0–1	11	21	4.1	5.7	9.1	38.1
2–4	31	61	10.3	10.5	41.9	42.3
5–7	14	23	12.0	9.0	50.0	39.1
8–15	22	29	7.3	9.0	18.2	41.4
All ages	78	134	9.2*	9.2*	33.7*	40.9*

*Standardized to the age distribution of all white patients.

higher, although not significant ($p = 0.15$). There was no difference between the one-year survival rates of the two groups of black children ($p > 0.50$), but the difference between the rates for the two white groups by type of hospital was significant ($p = 0.05$).

Median survivals for both races were shorter for children from county/charity hospitals than for those from private hospitals, and there was little or no difference between races within each hospital grouping. The discrepancy between one-year survival rates and median survivals by race was due to "crossing over" of the survival rates for blacks and whites (Fig. 1). The five-year survival rates were 5.3% for blacks and 2.3% for whites.

Because of the small number of patients, an adequate age-specific evaluation of socioeconomic factors could not be made. However, for the 5–7 age group, the higher survival of blacks seen in the total series appeared to be present in both types of hospitals.

For each of the five-year spans of the study, the ages at diagnosis and proportion of blacks to whites remained essentially constant. One-year survival rates improved over the 15 years of the study and appeared proportionally similar for both races (Table III). Small numbers prevented time-trend analysis by hospital type.

TABLE III. One-Year Survival Rate by Year of Diagnosis and Race

Year of diagnosis	Number of cases		One-year survival rate (%)	
	Black	White	Black	White
1955–1959	36	469	19.4	28.7
1960–1964	50	596	22.0	39.4
1965–1969	40	610	47.3	63.7

In the general population, there is a difference in mortality for blacks and whites in each age group. To control for these expected differences in attrition, all of the analyses were done using one-year relative survival rates (5). The results were the same as those which were based on the crude one-year survival rates reported here.

DISCUSSION

In this series, short-term prognosis was significantly better for white than black children. A reversal of this relationship occurred for children surviving more than four years. The number of long-term survivors was small, however, and this "crossing over" of survival curves may be due to chance. Two additional features of short-term prognosis did emerge: (1) survival of blacks relative to whites varied greatly by age, with blacks aged 5–7 actually surviving slightly longer than whites, and (2) the type of hospital (private vs county/charity) appeared to relate to survival.

Misdiagnosis of acute myelogenous leukemia as acute stem cell or acute undifferentiated leukemia is not a likely explanation for the poorer survival of blacks and those whites from county/charity hospitals. All of the cases in this series were confirmed by microscopic

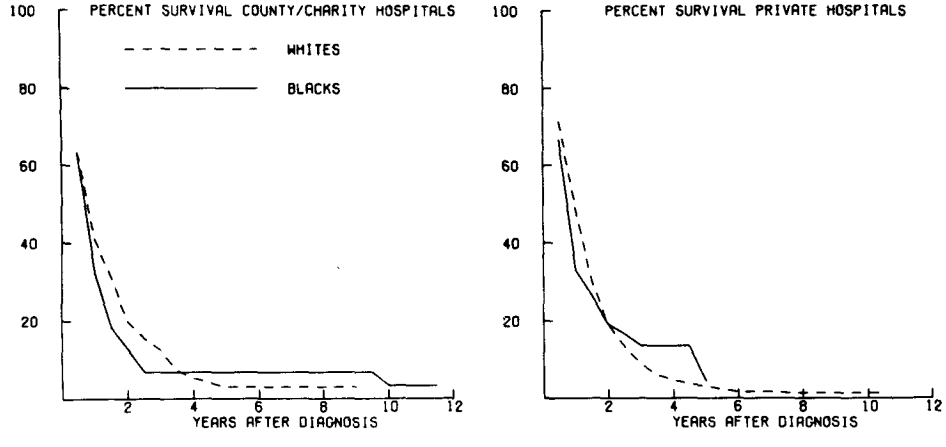

Fig. 1. Percent survival by race for county/charity hospitals and for private hospitals.

examination of blood or bone marrow, and the percentage of patients with ALL were similar to those reported by institutions and cooperative groups using more uniform diagnostic criteria (1, 9–12).

Though our series was not population-based, it was composed of a large group of hospitals from a broad geographic area. The age and sex distribution for both races is similar to those of previous population-based reports (4, 10, 13). In addition, the survival of the white children in this series is similar to other multihospital series (1, 4, 9–15) but is somewhat poorer than that reported by specialized cancer treatment centers (2, 16).

The racial differences in survival were not due to changes in the proportion of blacks to whites or distribution of patients by age at diagnosis in any of the five-year periods in the study. As anticipated because of the changes in therapy, our one-year survival rates improved over the 15 years of the study. However, the improvement appeared to affect both races equally.

There are many possible reasons for the age-dependent differences in survival between races. One prominent explanation for the improved survival of the blacks aged 5–7 is the onset at these ages of school health programs, which might tend to equalize opportunities for earlier diagnosis and treatment.

The differences in survival by hospital type seem to indicate that some of the racial variations may be due to socioeconomic factors. It is our contention that differences in therapeutic regimens are not the explanation since most of the patients in this series came from university-affiliated hospitals. We feel that some other component of socioeconomic status is responsible (for example, nutrition, housing, opportunity for early diagnosis, exposure to intercurrent infections, resistance to disease, sensitivity to therapy).

Resolving the relative contributions of race and socioeconomic variables to prognosis in acute lymphocytic leukemia will require more detailed socioeconomic data as well as information to evaluate extent of disease, specific therapeutic modalities, response to therapy, and the course of the disease.

Because cures in childhood leukemia are increasingly being described (16–18), it is important to determine the reasons for the poor short-term prognosis of blacks and whites from county and charity hospitals.

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